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◀ When told that some students had copies of questions which were to be used in a final examination, a professor answered, "Oh, that's nothing to worry about. I haven't changed the examination in ten years. Everybody knows the questions." His associates were flabbergasted. "Why don't you do something about it?" they asked. The professor answered quietly, "There's no point in changing the questions. They are always the same. Only the *answers* change."

And so, in this, the second Industrial Revolution, the answers once again are different. An industry, which will play a double-barrelled role in this Revolution, is *electronics,* which evolved from Dr. Lee De Forest's invention of the vacuum tube some 53 years ago, and whose sales and revenues have climbed from some $500 million just before the war to more than $13 billion in 1958. As industries in general expand and improve their technology and their methods, one of the most important tools will be electronic equipment. Whatever industrial or commercial field you have in mind, each one is destined to go through an *electronic* revolution in the next five or ten years.

An Electronics Boom

Electronics means television, radio, radar, "electronic brains" or computers, X-ray, and so on, but it does not mean an electric refrigerator, electric locomotives, or electric motors. This may be an over simplification but one way to look at electronics is to think of the electron tube; where you find it you have electronics. The electrons which are emitted when electricity is applied to that tube cause something to happen: a picture appears on your TV screen, a voice is transmitted over a microwave telephone network, a runway appears on a radar

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Electronic Economy

s a planning problem to every businessman.

Don G. Mitchell

screen, a printing press starts, a computer figures out a problem, or something is heard through a hearing aid.

Home applications of electronics have boomed with television and National Defense is becoming increasingly electronified, but the big, untapped reservoir is the commercial and industrial market, both from the standpoint of the way a product is produced and the end product itself. Whether you have in mind steel-rolling, food processing, transportation, or communications, the heart of these activities will be an electronic gadget of some sort. It may be a microwave communications network, some process control device, or foolproof airway navigation, but you can be assured it will be *electronic.*

To sense the possibilities, all you need do is to look at National Defense. There not only is electronic equipment which would counteract enemy radar, but there are counter-countermeasures to an enemy's countermeasures; there are man-made satellites which radio messages back to earth, and there are anti-missile missile systems. The wide area covered by just these few applications tells the story — electronics is as big as the universe. And that is literally true, because electronics put satellites up there.

Automation

Let's look for a moment at the effects of electronics upon manufacturing and upon capital expenditures.* There is every indication that industrial spending for new plant and equipment will keep on climbing and hit a new record. It will *have* to keep on climbing because we're going to have to keep on increasing and improving our productive capacity. We don't have any alternative, because it is the very key to the continued growth of our economy. You will note I said *increase* and *improve* our productive capacity. Making *more* of something is only part of the story; we must make greater quantities at *lower* unit cost in order to build our markets. Not only that, but *we must develop new products* and *new ways of making them* — and do all of that in the

*See the next article, "Procedures for Control of Capital Expenditures," by Alan H. Foster.

face of a technology that is producing more and more complicated products all of the time.

You can wrap up this entire subject under the word "automation" — the need for a broader use of electronically guided and electronically controlled equipment *to help men do their jobs; not* to throw them out of work, but to extend the breadth of man's mind and the power of his hands.

When you get right down to the word *automation,* it is simply another word for mechanization, a process which has been going on for a great many years. An interesting sidelight about mechanization, incidentally, is that it made possible certain large areas of electronics manufacturing, particularly receiving tubes, which have more applications than any other electronic product. And now the receiving tube, whose high quality and low cost were made possible by mechanization will, in turn, make possible broader mechanization.

The word *automation* scares some people, because it is human nature to resist change. They envision that the great bulk of our working force will be thrown out of work and that the few remaining employees will be relegated to positions as baby sitters to huge and complicated machines. This is fanciful and unrealistic. Machines remove *drudgery;* they do not remove *jobs.* There may be short-term dislocations, but the end result is that machines eliminate obsolete jobs and create many new jobs — better jobs and higher-paying jobs.

Let us look at automation in the manufacturing plant and then in the office; that is, *manufacturing automation* and *administrative automation.* In these two areas, I hazard the guess that American business will make larger capital expenditures in the next five or six years than in the past twenty-five, and that goes not only for manufacturing industries but for banks and transportation and the entire wide range of service industries. In these days of competition, it is necessary; a matter of survival. Those who do not make new capital expenditures will see their business and their investment washed down the drain of obsolescence. Some fairly prominent companies have learned this bitter lesson — but they learned it too late.

Manufacturing Automation

Present-day plants and equipment could never begin to do all of the work that will be required even in the foreseeable future. This presents an enormous planning problem to every businessman in the country. The backdrop against which everyone in industry must look at the future is this: *The rate of automation will have to be increased, let alone maintained, if we are to meet the future demands of our economy.*

By 1961, or even sooner, our Gross National Product should be getting up near $500 billion, and I wouldn't be surprised to see it near $600 billion within ten years and $800 to $850 billion by 1975.

These figures are simply a projection of existing trends. But the only way these potential demands can be met is by increasing our use of machines, for there simply won't be enough people in the working force to meet the steadily increasing demands for goods and services. That is, besides creating more jobs, *automation must fill 10 to 20 million job vacancies over the next 20 years,* the exact number depending upon how optimistic you are.

Such a demand was met once before, through mechanization: continued mechanization and *improved* mechanization

made up what would have been a shortage of 10 million people in the working force between 1947 and 1956. But, the startling fact today is that even if automation is continued at its present rate, every available worker — more than 80 million — will have to put in forty hours a week in order to keep raising our standard of living at the rate it is being increased today, let alone step up the *rate* of increase. Historically, the rate has increased year after year, but if we want it to keep on increasing, we need to increase our automation. Also, more automation is the only way to fight inflation. It will counteract the rising costs of doing business.

This is the task facing all of us in the years ahead, and it is going to require enormous amounts of new capital, but we won't have any alternative — if we want to stay in business. It's as simple as that.

Administrative Automation

Now let us look at the administrative side of business. You and I know what has been happening. The costs of running the administrative side have been rising steadily. The total cost of clerical employment in industry and commerce has been estimated at nearly $30 billion, and it is still rising. Fifteen years ago there were some 5 million clerical employees, or about 11 for each 100 manufacturing employees. Today there are upwards of twice the number, the ratio is more than 16 for each 100 manufacturing employees, and that percentage is growing. That is the story in a nutshell. Business has become so complex in every phase of its operations that better, faster ways of doing administrative work are becoming increasingly necessary. And yet, just as in the manufacturing plant, there won't be enough people to do the job that will confront us in a few years, so we must make broader use of machines.

That, of course, brings us to the electronic computer, because it is the heart of administrative automation. Without it, you might as well forget about administrative automation. As some already know from personal experience, the computer is without question the most compelling and far-reaching phenomenon to confront us for a long time. To my way of thinking, the computer is not simply an electronic gadget; it embraces the whole field of electronics. It is to electronics what the engine is to locomotion, what paper is to printing, film to photography, or electricity to lighting.

Let me inject a word of warning, however. Ingenious as the computer is, it is not a cure-all. It is an electronic tool, and that is all. A computer cannot think, although it certainly comes amazingly close to it — so close, in fact, that it fools people. But if you ask a computer a silly question, you'll get back a mighty silly answer. However, from the standpoint of any organization with a sizeable administrative operation, the computer *can extend your business procedures, systems, and planning* to a degree of skill, speed, and effectiveness that has never been even remotely achieved to date.

All of us know that the emphasis is on speed these days — speed and more speed. This arises not only from competitive conditions in existing markets but from the fact that industry's markets are steadily broadening as the country's standard of living rises. To stay in the race, operating information must be available at a speed at which it has never been available before. The problem of compiling, transmitting, and processing operating data has become increasingly difficult and costly. There is less time between events and because management must obviously base

its decisions on those events, it is absolutely essential that all levels of management have complete and significant information faster than ever before.

In looking at computers, you have to keep in mind one extremely important point: It is not simply a question of what the computer will do better or faster. Increased speed and the elimination of paperwork drudgery are the quick payoffs to the substantial sums that a computer and a data processing system cost. *Far more important, however, is the opportunity to do things we have never been able to do before or have never even thought existed before.*

Automation in the office is becoming just as vital a tool of industry as increased mechanization or automation in the manufacturing plant. After all, you can have the best engineering and manufacturing organization in the business but unless you know what products to make, how many to make, and where to market them —and know all of these things a little faster and a little better than the other fellow — you might as well close up the shop.

Communications

Although electronic computers have taken the limelight as far as industrial and commercial applications are concerned, there is an even broader area of which the computer is only a part. That "area" is covered by the one word *communications.* I am referring to communications in its broadest sense — *using electronics to gather information at its point of origin and deliver it to the point where it is needed.* This information can be the calculations of a computer, a telephone call from your automobile to your home, an inventory report from one of your plants to the head office, a closed-circuit television picture of the traffic density on an expressway, a radar picture of the air traffic pattern around a city, the control of the handling of ore at an unloading dock, a lecture from a university laboratory to classrooms all over the state, the regulation of the flow of raw materials through a fabricating plant, the quality control check on some highly critical metals, or the control of the Enrico Fermi atomic power plant. You could name a hundred examples, because "communications" is just as broad as your imagination.

Some of the examples I mentioned are already realities in varying degrees, others are in the drawing-board stage, others are in the laboratory, and still others are only dreams at the moment. But they will arrive one day, because the needs of our electronic economy will force their arrival whether we want them or not. It will be the only way that this increasingly complex economy of ours can be coordinated, integrated, and directed to do the job we have cut out for it.

You may be saying to yourself, "What an impossibly complex picture this author is painting." Let me reassure you on this point. It may be complex from the standpoint of the information the scientists will have to develop and the equipment and gadgets that engineers will have to design, but it will take the routine and the drudgery and the detail out of what we are doing and enable us to plan, to think, and to make more sense out of the general direction in which we are going. We won't have to spend so much time just holding on. Electronics will tie things together, but it won't tie them up.

The Payoff

Now let us answer the questions: Where will all this progress come from? What will it cost? What will be the payoff? How long will it take? For answers to these questions, we must look at the total research effort of industry, because the technological progress of any

one branch of industry — whether electronics, chemicals, machinery, or anything else — depends upon progress in another. Think in terms of what industry as a whole is doing in research and development for the future as well as what is going on in a particular industry such as electronics.

We are surrounded today with scientific and engineering achievements. The past twenty-five years have seen more technological change than all the preceding years of recorded history. For the first time in the history of man, dramatic, far-reaching changes take place in a single generation or even less.

What does this enormous research and development effort cost today? Industry's research and development work costs at least $8 billion annually or a little less than 2 per cent of our Gross National Product. Only a few years ago, it hardly totaled $1 billion. The industry with the largest research expenditures is the electrical-electronics industry with outlays of more than $200 million of its own money annually, plus another $600 million in Government-sponsored projects.

What does industry get back in dollars and cents from its investment in research? Why should a company spend millions of dollars in research and development? The National Science Foundation came up with this amazing answer: Over the past 25 years, research expenditures have paid off at the rate of from 100 to 200 per cent each year. For every $100 spent on research and development, the return over a 25-year period has been from $2,500 to $5,000.

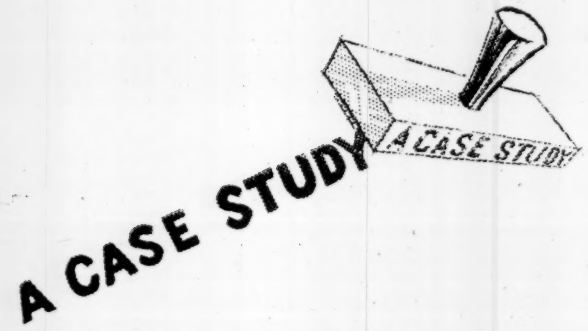
Now let us ask another question. How long does it take to get tangible benefits from research? The general opinion throughout industry is that the average time lag from the initiation of some new project in the laboratory to the time that a new or substantially improved product appears on the market is ten years. The actual time lag may be seven or eight years in the case of one development or it may be twelve in the case of another, but the *average* is about ten.

If you were to review a cross section of the leading companies, you would find that from 50 to 75 per cent of their sales today are derived from products which did not exist or are basically different from those which existed fifteen years ago. Does a progressive management need any more proof than that?

As far as electronics are concerned, research will produce not only the broader concept of communication mentioned above, but there will be such accomplishments as radar steering of automobiles, anti-collision devices, electronically activated brakes, and so on. In the home, electronics will broaden electroluminescent lighting to the point where entire walls and ceiling will light up — and your television, radio, telephone, and intercom systems will be linked together into one system. Your house will be heated electronically and electricity will be conducted not through wires but by electronics — and extension cords and outlets will be a thing of the past. There will be machines that will type spoken words directly onto paper and other machines which will translate foreign languages as fast as they are spoken. There will be light magnifying devices to see in the dark and tiny radio telephones for your pocket.

When you look at any technological or economic trend, however, do not lose sight of the fact that progress is man-made. An electronic computer is an amazing thing but man designed it, man built it, and man thinks for it. **s/p/a**

Procedures for Control of Capital Expenditures



Alan H. Foster

► No phase of business management is more important today to the progress of individual industries and the well-being of the economy as a whole than control of capital expenditures. This area is of vital interest to almost every segment of our economy. Some government officials have praised large outlays made by American industry over the past ten years as being responsible for the country's high standard of living. Others are now asserting that these outlays were and are the cause of inflation. Business publications and government agencies conduct surveys on capital expenditures as a means of predicting the outlook for the economy. The businessman pays attention to capital expenditures within his industry to make sure he is keeping abreast of other companies and watches for indications of overexpansion.

Alan H. Foster is Assistant to the President of Sylvania Electric Products Inc. in New York. He received his bachelor of science in business administration degree from Boston College and his master of business administration from the Harvard Business School. Mr. Foster joined the company in 1953. Up to 1956 his assignments included material efficiency programs, setting budgets for new plants, and revising production control and scheduling systems. From 1956 to 1959 he was corporate coordinator of capital expenditures. He assumed his present position in January, 1959. Mr. Foster has taught business subjects at Boston College and Northeastern University Graduate School of Business Administration.

The significance of a good capital expenditure program cannot be over estimated and is of immediate concern to an individual company. Decisions in this area affect an organization for years to come. Contrast an *operating* decision to reduce overtime or to put on a second shift with that of building a new plant. The plant is being built on a sales forecast for a 5- or 10-year period in the hope that it will be utilized for the next 50 years. Whether the forecast materializes or not, the plant is built and will probably house new equipment. Regardless of sales, this plant and equipment become part of the company's investment. A decision about overtime can be changed at will, but a decision to build a plant is a long-range commitment with which a company must live.

We at Sylvania find ourselves in the fastest growing major industry in the world today — electronics. Because of the pace, it is extremely important to the company that its capital expenditure controls be adequate, that it should not over expand or remain too small, and that it should not over mechanize or be satisfied with the status quo.

As a result, the procedures used at Sylvania for planning and controlling capital expenditures have features in common with the programs of many other companies, but in addition include special procedures to fit the specific requirements of a fast growing industry and a faster growing company.

Background

Not many years ago, the electronics industry as we know it today did not exist. Aside from the manufacture of the various components of radio, there were none of the developments which today have come to be synonymous with electronics — television, microwave communication, radar, computers, and others which are commonplace today. At the end of 1948, the annual volume of the electronics industry was $3 billion. At the end of 1958, the annual volume was $13 billion and it is anticipated that it will increase about 50 per cent within the next four or five years so that by 1965 it will be up to $25 billion or more. Sylvania has shared in this growth. Its net sales have increased from $69 million in 1946 to about $400 million in 1959. Although sales have increased fivefold, employment has only doubled. This is an indication of the role capital expenditures in mechanization have played. In 1946, Sylvania had 21 plants. It now has 45. Also, it has 22 laboratories, 32 sales offices, 29 distribution centers, and 9 wholly owned subsidiaries.

To illustrate further the role capital expenditures have played, the net plant and equipment account (after subtracting depreciation) in 1946 was $12 million. At the end of 1958, it totaled $78 million. The last eight years (before depreciation), we spent $123 million on new plants and equipment.

Policies

The rapid growth of the electronics industry has strongly influenced the type of capital control system Sylvania has developed. Basic to our system has been a philosophy of maximum decentralization of control. Authority and responsibility for planning and profitability have been delegated to divisions and plant managers. Central management is equipped with minimum control to assure results.

Sylvania has pursued a course of aggressive replacement of obsolete equipment. Replacement in expansion items is requested and approved only after weighing the relative risk involved and the

comparative call on new capital. Alternate choice is fundamental to the program. Company policy calls for preparing programs as far ahead as possible and then putting them into effect at the last minute. Decisions are deferred but when once made, they are carried out with maximum speed.

The controls of capital expenditure at Sylvania seem to apply equally well to all its products and all divisions.

Setting the Permanent Property Budget

1. *Cash Available for Next Year's Permanent Property.* The first step in setting the Permanent Property Budget, using 1959 as an example, is made by those at the central office who must decide around the first of February, 1958, how much money will be available for capital expenditures in 1959. Usually the treasurer and the financial vice-president decide on the amount by forecasting and considering key factors such as depreciation, retained earnings, and increase in working capital. If, for example, retained earnings are $10 million and depreciation $9 million, cash generated for the coming year will be in the vicinity of $19 million. If $8 million of this is required for working capital to finance additional sales, $11 million remains for capital expenditures or permanent property. The divisions are told of the amount available for 1959 permanent property and at the end of February, 1958, they draw up their 1959 budget, keeping the needs of the other divisions in mind. A meeting is held on divisional budgets around the first of April. Usually two or more meetings are held. In addition, the financial vice-president visits each division before the money is allocated for 1959.

2. *Permanent Property Budget Forms.* So that one division can be compared with another and so that meaningful summaries can be presented at the meetings mentioned above and finally to the board of directors, the following forms were devised for each division's use:

Form A lists the *Total Cash and Commitments* requested by a division. The cash figure is made up of "carryover" (requisitions placed for equipment in 1958, but payment to be made in 1959) and new cash (equipment not yet requisitioned but to be requisitioned in 1959 and payment to be made the same year). To avoid an end-of-the-year rush by the divisions to use all their 1958 money, a division receives new money for 1959 expenditures plus money for items requisitioned in 1958 that have not been paid for.

"Carryover into 1960" is also a required figure. It consists of requisitions to be placed in 1959, but payment to be made in 1960. Sylvania considers carryover into future years important since, not knowing to an exact degree what money will be available for permanent property in future years, it does not want to commit itself to large future expenditures.

Form B lists the *Total Investment.* Total investment includes permanent property money to be spent on programs in the budget year plus all other permanent property outlays spent in the past and anticipated in the future for the program being budgeted. All associated expenses, increases in working capital, etc., must also be included.

Total investment is very important. Without it the company might, for example, be led to believe it was committing itself to a $2 million plant. In reality, however, the plant might house $1.5 million worth of new machinery and

(YEAR) PERMANENT PROPERTY BUDGET

(DIVISION)

Total Cash and Commitments Required

(000'S OMITTED)

Program (1)	Description (2)	Estimated Current Cash Carryover To Be Spent In Budget Year (3)	New Cash To Be Appr. and Spent In Budget Year (4)	Total Act. Cash Needed in Bud. Yr. (5)	Funds To Be Committed Other Than Cash Expend. in Bud. Yr. (6)	Total Cash & Commitments For Bud. Year (7)

EXPLANATION

(1) PROGRAM — Program number for divisional control.

(2) DESCRIPTION — Brief description of program itself, rather than category (Form C).

(3) CURRENT YEAR CASH CARRYOVER TO BE SPENT IN BUDGET YEAR — This is Cash only.

(4) NEW CASH TO BE APPROVED AND SPENT IN BUDGET YEAR — CASH ONLY.

(6) FUNDS COMMITTED OTHER THAN CASH EXPENDITURES IN BUDGET YEAR — These columns represent funds that are or will be committed prior to the end of Budget Year for which actual cash will not be needed until a subsequent year. Funds are "committed" when PPR's are approved.

(7) Total cash and commitments for Budget Year — These total figures are arrived at by adding columns 5 and 6.

FORM A

FORM B

(YEAR) PERMANENT PROPERTY BUDGET

(DIVISION)

Investment, Return on Investment & Cash Pay Back Period

(000'S OMITTED)

		TOTAL INVESTMENT								
Program Description (1)	Total Cash & Commit. (Year) (2)	PP. Amts. Spent in Past Yrs. To Eff. Savings (3)	Other PPR Amts. Req'd To Complete Program (4)	Total Exp. Req'd @ 50% to Eff. Svg's (5)	Total Working Cap. Req'd To Eff. Savings (6)	Total Program Cost (7)	Annual Savings After Depr. Before Tax (8)	Ret. on Total Program Before Tax (9)	Annual Savings Before Depr. After Tax (10)	Cash Payback Period (11)

EXPLANATION

(2) TOTAL CASH AND COMMITMENT (YEAR) — Must agree with Column 7 — Form A.

(4) OTHER PPR AMOUNTS REQUIRED TO COMPLETE PROGRAM — PPR's in connection with long range program to be approved in future years.

(5) TOTAL EXPENSES REQUIRED @ 50% TO EFFECT SAVINGS — 50% is used for convenience to reflect Federal Income Tax.
Total Expenses include CURRENT, PRIOR & FUTURE years required in order to produce savings shown in columns 8 & 10.

(7) TOTAL PROGRAM COSTS — This is sum of columns 2, 3, 4, 5 and 6.

(8) ANNUAL SAVINGS AFTER DEPRECIATION BEFORE TAX — Policy and standard practice #204 (S-2) for compilation of Annual Savings.

(9) RETURN ON TOTAL PROGRAM BEFORE TAX — Total program investment as shown in column 7 rather than "Average" Investment. Before tax rather than after tax.

would require a $1 million warehouse to contain another $1 million increase in the company's stock of finished goods. Accounts receivable might be predicted to increase $1 million dollars, so that instead of a $2 million investment, one of $6.5 million would be involved.

Form C breaks down *Permanent Property Expenditures* by category. It is used to enable the corporate office and board of directors to compare divisions and to see where permanent property emphasis is being placed for the next year.

3. *Acceptable Return on Investment* is used at Sylvania as a rough guide to decide whether an investment is acceptable or not. No set return on investment is required for any capital expenditure. Through the calculations found in Form D, Sylvania considers its over-all pre-tax *Minimum Acceptable Return on Investment* to be approximately 14 per cent. Any return below this figure dilutes the stockholder's equity. In order to be assured that the over-all permanent property budget yields at least an over-all 14 per cent return, it is necessary that certain types of expenditures, such as those for cost savings and expansion, must yield a return in the vicinity of 25 to 50 per cent to compensate for expenditures that earn little or no return. Administrative buildings, laboratories, offices, and washrooms are some of the expenditures that fall into this category of little or no return.

The return of 14 per cent is also a guide. If it were strictly adhered to, it would mean that equipment and plant for new products or research would never be considered since payoff is usually in the future. The minimum acceptable return on investment of 14 per cent is also Sylvania's cost of capital; that is, the amount it would currently pay for capital under its present debt structure.

4. *Return on Investment and Payback Period* are computed on a simple arithmetic basis. MAPI (Machine Allied Products Institute's formula), discounted cash flow, and others have all been explored. Upon scrutiny, however, it was thought that under these refined formulas, a cost saving estimate being multiplied by an absolute (such as annuity table figures) gives the resultant figure a significance is does not deserve.

Approval and Processing of an Individual Request

1. *Content of Permanent Property Budget.* In preparing its 1959 permanent property budget, each division groups many requests under programs as outlined in Form C. The eventual program approval by the board of directors does not mean that a division has permission to spend money. Approval only signifies that the board agrees to the direction and growth a division proposed. Before money is spent, a requisition for the piece of permanent property must be prepared and depending upon the amount of money involved, approved by certain individuals.

2. *The Individual Requisition.* Form E. is a permanent property requisition. The requisition is used to determine such things as total investment, investment of a particular machine, and investment of the total number of machines in the program. Each requisition is judged on its merits. However, computations greatly help those approving to decide whether an investment is acceptable.

3. *Acceptable Return on Investment.* The company uses two mathematical computations to figure its *Payout Period* and *Return on Investment.* Payout period is significant to foretell the cash flow; that is, how soon the machine will generate money to pay for itself in terms of years. Return on investment is signifi-

(YEAR) PERMANENT PROPERTY BUDGET

(DIVISION)

Breakdown of Expenditures by Category

(000'S OMITTED)

	CASH (Form A Column 5)	% OF TOTAL	CASH & COMMITMENTS (Form A Column 7)	% OF TOTAL
BUILDINGS				
REPLACEMENT				
EXPANSION				
LABS. & PILOT				
ENGINEERING				
EQUIP. DEVELOPMENT				
SUBTOTAL				
MACINERY & EQUIPMENT				
COST SAVINGS				
REPLACEMENT				
EXPANSION				
NEW PRODUCTS				
EQUIP. &. MECH. DEVEL.				
ENG. & LABS.				
OTHER*				
TOTAL				

*May include outlays for land and other capital items as well as machinery and equipment; if substantial, explain by footnote.

FORM C

cant since it gives an indication of the investment's profitability. The requisition is made out by men in the plants who are requesting the equipment. The calculation is kept simple, easy to understand, and consistent throughout the company.

Cash Payback Period. The following example illustrates how Sylvania computes its payback period. The total investment in this example is $16,000, and the annual added profit before depreciation after taxes, $5,500. By dividing the generated cash of $5,500 into the investment of $16,000, the payback period is almost three years:

Annual added profit	$10,000
Less depreciation	1,000
Annual added profit less depreciation *before* taxes	9,000
Less income tax	4,500
Profit A/O & A/T	4,500
Add depreciation	1,000
Annual added profit before depreciation *after* taxes	$5,500
Investment	
Machine	$10,000
Expenses after taxes	2,000
Increase in working capital	4,000
Total investment	$16,000

MINIMUM ACCEPTABLE RETURN ON INVESTMENT

PRE-TAX COST				
CURRENT MARKET	WHEN ISSUED	TYPE OF DEBT	AMOUNT	COST OF NEW MONEY
4½ %	4¾ %	SINKING FUND DEBENTURES	$ 20,000,000	$ 900,000
4½ %	4½ %	CONVERT. S.F. DEBENTURES	20,000,000	900,000
4½ %	3¾ %	SINKING FUND DEBENTURES (NOV. 1, 1971)	21,851,000	983,000
4½ %	4 %	SINKING FUND DEBENTURES (FEB. 1, 1978)	17,000,000	765,000
10 %	8 %	$4 CUM. PREFERRED	9,582,000	958,000
20 %		COMMON STOCK (OUTST. 3,526,000) MARKET PRICE $35/SHARE EARNING $7.00/SHARE	127,824,000	24,682,000
		TOTAL DEBT	$216,257,000	$ 29,188,000
MINIMUM ACCEPTABLE RETURN ON INVESTMENT 14 %				

FORM D

Payback Period: Investment of $16,000 divided by $5,500 equals 2.9 years.

Return on Investment. It has been the custom at Sylvania over the years to refer to its "return on investment" *before* taxes. By dividing by 2, the *after* tax return on investment can be figured mentally. Continuing the above example, the same investment of $16,000 now has savings *less* depreciation before taxes of $9,000. By dividing the investment of $16,000 into the savings of $9,000, the result is a 56 per cent pre-tax return on investment:

Annual added profit	$10,000
Less depreciation	1,000
Annual added profit less depreciation *before* taxes	9,000

Investment

Machine	$10,000
Expenses after taxes	2,000
Increase in working capital	4,000
	$16,000

Return on Investment: Savings of $9,000 divided by $16,000 equals 56 per cent.

Sylvania does not use one calculation without the other. If one is used, a false picture is received. For example, assume that $10,000 is invested in a truck with a life of three years. Without knowing the life of the truck, this would seem like a very good investment. By using the return on investment calculation, we find that the pre-tax return is about 7 per cent and after taxes, 3½ per cent. Currently, savings in commercial banks will give 3½ per cent on money placed in its care.

SYLVANIA ELECTRIC PRODUCTS INC. **PERMANENT PROPERTY REQUISITION** PPR. No.

Division_____ Plant: _____ Date _____

Program No:_____ Program _____ Plant Req. No._____

1 - DESCRIPTION OF ITEM(S)

SUPPLIER_____ EXPECTED DELIVERY DATE _____
EXPECTED PROJECT COMPLETION DATE _____

2 - REASON FOR EXPENDITURE WAS THIS REQUISITION INCLUDED IN APPROVED PROGRAM?_____

3 - TOTAL INVESTMENT	THIS PPR	PROJECT
Plant or Equipment	$	
Transportation and Installation	$	
Cost To Be Capitalized	$	$
Less: Salvage Value Obsolete Equipment	$	
Net Capital Outlay	$	
Plus: Non-Recurring Expenses, after taxes (S.E.R.#)	$	
(E.D.R.#)	$	
Working Capital Required (if any)	$	
TOTAL INVESTMENT	$	$

4 - PROFIT IMPROVEMENT	THIS PPR	PROJECT
Annual Added Profit (before deprec.-after taxes)*	$	$
Annual Added Profit (after deprec.-before taxes)**	$	$
Cash Payback Period	years	years
Return on investment	%	%

* Divided into total investment to give "PAYBACK" in number of years
** Divided by total investment to give "RETURN ON INVESTMENT"

5 - EQUIPMENT OBSOLETED TAG NO:
Description and Disposition

Purchase Date.....First Cost $.....Net Book Value $ .....Location.....

6 - CAPITAL EXPENDITURE SUMMARY	Allocated	UNREQUISITIONED BALANCE	DEPR CLASS _____ YRS _____ EST. USEFUL LIFE YRS _____ DEPT OR PROD. LINE _____
TOTAL CAPITAL AMT. OF DIVISION 19 19			

7 - APPROVALS	Date Approved		Date Approved
Industrial Engineer		Div. Controller	
Plant Mgr.		General Mgr.	
Cost		Operating Vice Pres.	
Gen. Mfg. Mgr.		Financial Vice Pres.	
Purchasing		Board of Directors	

SY-112(10-57) COPIES: Pink and Blue for Approvals; Blue for N.Y. Files; White and/or Yellow For Issuing Offices.
See Policy and Standard Practice #204, Supplement 2, for preparation instructions.

FORM E

Investment for Truck	$10,000*
Life of Truck, 3 years	
Depreciation per year	3,333
Annual added Profit	4,000
Less Depreciation	3,333
Annual added Profit Less Depreciation before tax	667**
Less Taxes	333
Profit after Depreciation and Taxes	334
Add Depreciation	3,333
Annual Added Profit before Depreciation after Taxes	$ 3,667***

Return on Investment:

$$\frac{\$667^{**}}{\$10{,}000^{*}} = 7\% \text{ before Taxes}$$

Payback Period:

$$\frac{\$10{,}000^{*}}{\$\ 3{,}667^{***}} = 2.7 \text{ Years}$$

This is not a very lucrative investment since tax-exempt bonds will assure a return equal to this. But without using the two formulas, if payback period alone were used, an individual could be misled. As mentioned before, these mathematical formulas are only guides. Some investments, legal quality, and safety will yield no measurable return on investment of payback but do take priority in any capital expenditure program.

4. *Savings on a New Proposal.* Each requisition submitted must be the best choice from several. Savings calculation is made on out-of-pocket savings. No overhead is added to direct labor, except 20 to 25 per cent to reflect out-of-pocket fringe benefits. On equipment which will increase production, current sales volume is taken rather than average sales over the next five years. Both methods bring conservatism to the estimates made at the plant level.

5. *Levels of Approval.* Any requisition over $15,000 must be approved by the vice-president of finance. In addition to him, any requisition over $100,000 must be approved by the board of directors. Requisitions below $15,000 are approved within the organizing division. It should be added that although some individual requisitions by their nature do not show a return on investment, etc., these are approved in confidence, knowing that they are part of an over-all budget which might show, for example, a 45 per cent return on investment. When signing requisitions of this type, the lack of profitability is mentally compared with the division's entire permanent property budget.

Post Completion Audit

Six months after the capitalization of an item or project costing over $15,000, a post-completion audit is made. The audits report the actual savings as compared with those given on the approved requisition. If there are any significant variances, they are explained at this time.

Summary

This is a brief description of the procedures Sylvania follows in arriving at what is considers to be a realistic permanent property program. It should be noted that a full year is spent preparing and revising the budget before final approval is given. Division headquarters and the corporate office are concerned chiefly with the actual dollar value of anticipated expenditures in a particular plant, whereas it is the plant's responsibility to select the most lucrative investment items necessary to the manufacturer of its product. Sylvania feels that the man on the firing line knows more about what is needed than those not intimately concerned. Each plant and division is responsible for its profits and the return on its total investment. **s/p/a**

How To Use Simulated Systems

A simulated system, a model, is a research tool.

Richard Myrick

► While the concept of systems has been known for a number of years, an adequate tool for dealing with system research problems has been lacking. An effort to fill this void is described here. The tool is a *model* or simulated system. More specifically, it is a behavioral model; that is, an arrangement wherein people do certain jobs and influence each other in certain ways. The model may or may not have the same physical appearance as the actual system under study, but it must resemble it in ways such as the authority and responsibility patterns, the communication network, and the laws and conventions that actually exist.

Systems Research

Let us consider first the simulated system as a tool for systems research. What are the earmarks to look for which will suggest that a simulated system is appropriate? The first is a system in such an unwieldly condition that tentative changes would be difficult to introduce and would be unclear in their outcome. A second sign is a considerable interdependence among various parts of the system so that to make a change in one is difficult without compensating changes which cannot be anticipated in other parts of the system. And third, whatever is to be studied must be "simulatable." Building a simulated system is a little like staging a play. Those things which can be represented by small samples of themselves, such as one room representing a whole house, are most likely to succeed.

The richness of the results appears to be limited by the extent and quality of the simulated system. But in the several

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simulated systems to be described shortly, note certain common characteristics.

1. They center on a system or number of individuals trying to work together as a team.
2. A carefully planned, fully known task is presented.
3. The actions of the group are recorded.
4. There is an opportunity for feedback and analysis so that the whole process can go forward in a meaningful way.

Simulated systems have two general aspects which should be mentioned before going further. One is their usefulness in training people to work within a system. The second is an aspect against which one must be warned; namely, their similarity to business games.

Insofar as a business game is a true game, it emphasizes the competitive aspect and the final outcome; records and decisions are focused on winning. The trouble is that the scores in the game, the winning score and the losing score, are decided by predetermined values — just as in a football game, someone decided ahead of time that a touchdown would count six points; a field goal, three. The simulated system, however, provides more of a training exercise in which individuals strive to work together. The emphasis is on *process* and improvement of process rather than on achievement measured according to a scale of arbitrary standards.

Simulated Administrative Systems

The simulated administrative system is probably most useful for training potential management people. When organized into a functional group, one can present to them a series of "inputs" representing a problem. The important thing is to distribute the fabricated problem among a number of people. It must also be coordinated; information must be on hand where it is needed. Possible duplication must be detected. This must be accomplished with a minimum of effort, for it is no more than a preparation. After a problem has been "solved," there should be a complete disclosure to the group. They should have the opportunity to see both the problem and their actions. No effort should be made to determine the correctness of these actions. It is best to have any evaluation come from the "players" themselves.

The main thing to be achieved from a simulated administrative exercise is gaining insight into the team process which might not be available in the daily run of activities. Learning, as I use it here, means something quite different from acquiring familiarity with certain factual materials or administrative processes. It deals first with redefining goals. For a large organization, there are often many goals so that it is impossible to put them into a few written statements. They form a complex of desired "states" which changes from time to time. It is important for management personnel to exchange views on this topic. In real life, this exchange often does not take place but in a simulated system, there *must* be an exchange of views.

It is important to note certain key differences between a simulated problem and what is known as "executive development" programs which, in effect, seek to change the man. The sharpest difference is in the clinical approach. Rather than say, for example, that the efficiency of an organization is reduced because some of its members have emotional problems, in simulation it is possible to explore the supposition that reduced efficiency is due in part at least to the very nature of the organization. Thus changes in the organization may be considered as well as changes in personnel.

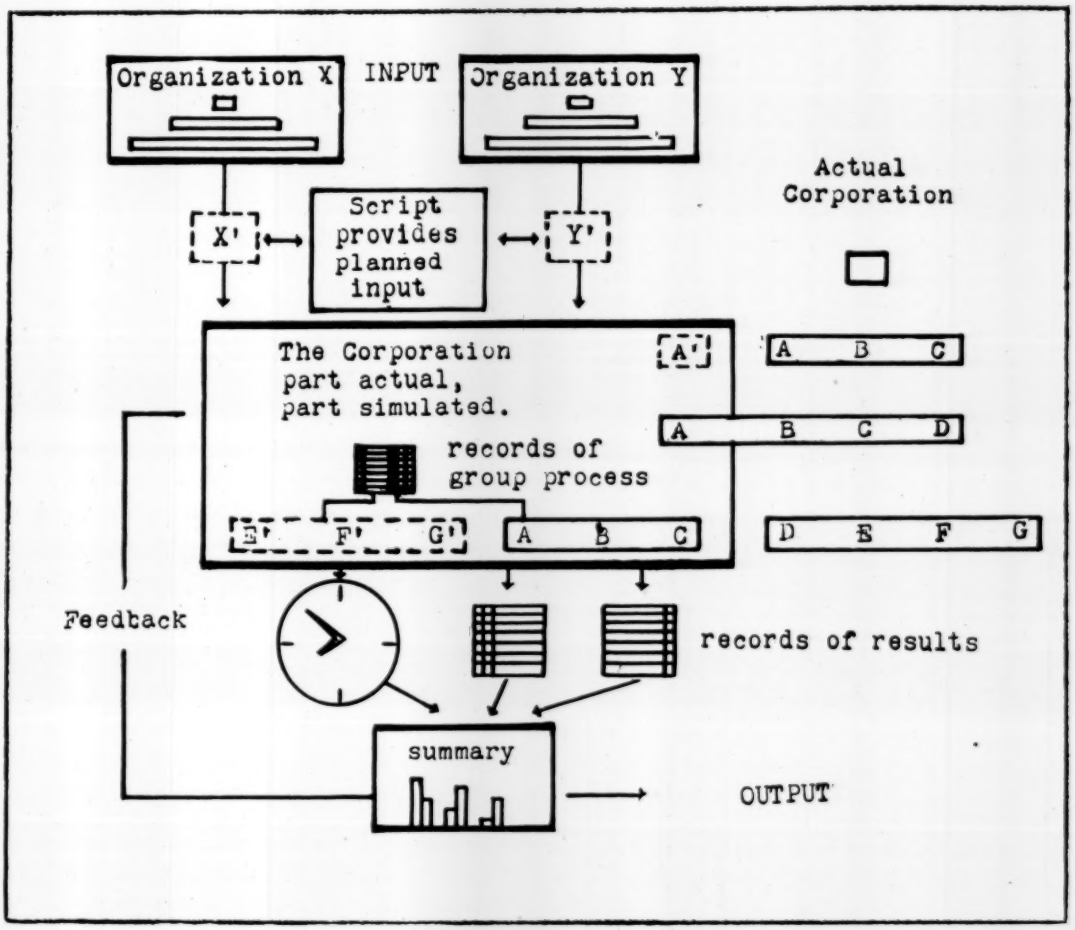

FIGURE 1 — A SIMULATED OPERATIONAL SYSTEM

To the right is the actual corporation. To the left is the simulated system in four parts: the input, the simulated parts of the corporation (indicated by dotted lines and prime letters), the actual parts of the corporation, and the output. The participants, in the right half of the rectangle, communicate either among themselves, the simulated parts, or the outside organizations, X and Y. All actions are recorded, summarized, and if training is the goal, fed back to the participants.

Simulated Operational Systems

The design and construction of a simulated operational system is an ambitious undertaking. When not a total system, it involves at least a sub-system. The main features of a simulated *operational* system are shown in Figure 1.

Simulated systems of this type lend themselves to problems of coordinating, in a rather detailed manner, the main elements of a company. For example, a problem might exist in controlling the production and distribution of a manufactured item. Or the problem might center on the allocation of equipment in order to provide good service. In simulating this kind of problem, one or more persons must represent each of the major parts where human action takes place. Some of these parts would be within the model; others, such as the *input* to the system, could be outside. In other words, there are two groups here: (1) Those persons who work within the simulated system and (2) A number of persons who

set up and conduct simulated activities, but who are on the outside. And just as the model would give a small-scale representation of the actual larger process, so its time span could be compressed. A few days, for example, might represent several weeks.

Keeping in mind that a model is a research tool, we might first use it to examine existing operations. By means of its controlled input and recorded output and its feedback to those working in the system, a model provides improved understanding of existing operations. It is possible to try certain improvements and reasonable to expect progress by this method. Even if a man has been working in a system for a number of years, he still has little way of knowing how to improve his contribution unless he can see his influence in terms of the larger picture. Parenthetically, it is interesting to note that attempts to gather this kind of information are frequently made at social functions. For example, people in one department often like to compare notes with people from other departments, especially when their work is related but no informal communication channels exist.

In addition to studying and revising individual performance in a system, it is possible to test different operating philosophies. For example, problems of logistics are often seen as a question of centralization versus decentralization. The greater economy of a large centralized system must be weighed against the immediacy of the decentralized system. By means of setting a criterion, for example conserving cash or maximizing sales, one can collect relevant output data and the making of the choice can be simplified.

The simulated operational system can also be used for training. Ideally, the sequence should aim first to evolve the best possible system and then train individuals in its use. The kind of training intended here is team or system training. It is assumed that each individual knows how to do his specific task but somehow, even though a series of individual tasks are properly done, the total team product falls short of the mark. Knowing how to perform as a member of a team is quite different from knowing how to perform as an individual. The former involves a knowledge of team goals and team achievement and the precise effect of one's own actions upon the team.

The operational system has other uses. The area of information processing which qualifies as an *operational* system is an example. Here, instead of controlling a flow of *materials,* the emphasis is on controlling a flow of facts or *data.* The communication symbols which pass back and forth do not stand for hardware; instead, they stand for certain things which are known and which trigger off certain actions.

What are the problems which beset information processing systems? Again, they relate to the individual who functions as part of a team. How can he know that information he needs has not been received elsewhere in the system? Or, how can be know that a piece of information, seemingly trivial to him, is not of vital importance to another? The simulated system can tackle problems of this nature. Solutions can take two forms: the rules under which the system operates can be changed, or the individuals who comprise the system can learn the special cues needed to provide a "system consciousness."

It is to be assumed that what has been said applies not only to human systems but also to man-machine systems. In real life, such systems may be highly complex. Machines can perform automatic operations which exceed the speed and strength

of humans, but they must be combined with the activities of a human who can learn, make decisions, and be motivated. Probably the best application for this type of simulated system is training.

Limitations

Let us now go back and examine some limitations in simulated systems. Size is one consideration. A model is supposed to provide a small easily understood sampling of a larger system. The purpose is lost if the model becomes too elaborate. What is to be gained if several sub-systems are simulated at one time? Hopefully, new and important relationships may be found between sub-systems. If such relationships are suspected, as they frequently are, a fuller understanding of them is more likely from a series of smaller models. An alternative, when such a situation arises, is to stick to one sub-system and expand it lengthwise. Steps which occur earlier in the process, as well as those which follow, should be included. The problem then is to decide among a number of parallel or sequential sub-systems. Although there may be special cases, it would seem that the parallel arrangement would provide more chances for interaction.

A Final Word

When can one *stop* performing research in systems? Or, to put it another way, assuming that a company is making a profit and that the profit increases from year to year, how can one know that a company has reached the upper limit of system effectiveness? Although there are a number of specific characteristics of "good systems," the real point of the question is to stimulate a search for appropriate criteria and better systems. Thus the end-result of research in systems is not only improvement in organizational processes but also the ability to evaluate such improvement. **s/p/a**

Worth Reading

"How to Do Paperwork by Remote Control," *Modern Office Procedures,* June, 1959.

Describes a master and a four slave-typewriter system for order distribution. An order clerk types orders on a master typewriter and slave machines record selected data in the laboratory, production, accounting, and shipping areas. Slave machines are programmed to receive only the data needed in the area.

"Organizing an Analysis Service in the Controller's Department," Harold W. Fox, *NAA Bulletin,* June, 1959.

Detailed exploration of the role of an internal consulting service for financial analysis, commercial research, management audit, and similar work. The purpose of such service is to facilitate decision making by relieving management of the time-consuming tasks of investigating and interpreting complex business affairs. Aspects covered are: range of investigations, starting the function, controlling the work, and reporting results.

"Steps in Achieving Control of Material on an Electronic Computer," H. Warren White, *NAA Bulletin,* June, 1959.

General description of Lockheed Aircraft's experience in material control with an IBM 705. Half of the material control process is automated. Manual processing is used for procurement scheduling, determination of order quantity, price breaks, and inventory level. Automated routines are used to process orders, receipts, and disbursements which result in automatic selection of items needing further action.

Total Systems

Let us select the problem of mobilizing the entire economy for defense.

Max Carasso

Can computers—

make decisions?

eliminate line and staff problems?

reduce management overlayering?

organize an over-all economic mobilization?

Revolution by Computer

In the everyday world, total solutions are rarely indicated and even less rarely effected. During recent years, however, the introduction of a computer has resulted in a complete revamping in many business concerns, for better or worse, of previous methods. In many cases, the computer compelled a long overdue reorganization in office procedures. Previous efforts to *integrate* data processing had been frustrated by the usual objection of "our department is different" although as has often been demonstrated, no department is "different" in its routine data processing aspects. Even creative departments (art) or inventive departments (research) have routine aspects which can be included in a centralized data processing system. Of course, the real reason for opposition to integrated data processing usually is not that "our department is different" but fear of change, of lost prestige, of adaption to a new system, or even of possible disemployment. And, if the introduction of a simple integrated data processing system is disturbing, the introduction of a *computer* is often frightening, for here is a monster which, in popular imagination, threatens to preempt every desirable job now held by a human being.

Max Carasso is an economic consultant and theoretician in industrial development and foreign trade. His publications include articles on foreign investment, business management, incentive planning, and economic mobilization. He is a member of American Management Association, International Management Association, American Ordnance Association, and of the board of governors, New York Chapter of the Association of the U. S. Army.

Often, the introduction of electronic data processing compels a company to do what should have been done long before, with or without a computer. The now classic example is the company that, by installing a large-scale computer, saved half a million dollars annually in clerical costs and then disposed of the computer two years later for an estimated saving of another half million a year. The answer? The company did not really need a computer; it needed the *improved data processing methods* whose adoption was made necessary by the computer.

However, whether or not a computer is necessary in a particular organization, one psychological factor seems clear. No systems and procedures man (or team) is likely to make much headway against the increasing "overlayering" of management and the growing complexities of line and staff organization without the prestige of a computer installation. In business as well as in Government (especially the defense branches), the constant proliferation of functions is accompanied by makeshift administrative control arrangements. The result, in most cases, is a hodgepodge of central administrators, groups, and committees in an effort to unify related functions and to re-establish administrative logic. The consequent conflicts of line and staff are a recurrent theme in management seminars.

The Problem is Real

Some "administrative" problems come to the surface in terms of jealousy, power-grabbing, favor-seeking, and other examples of human cussedness, but the basic problems are usually not human and psychological. They are technical and real. The proliferation of functions arises for the most part because of rapid increases in the variety and complexity of modern technology. Experts in one field must now pool their knowledge with other "experts." Research and production projects, formerly well defined and controlled by one department head now may intrude into areas formerly regarded as "other departments' " domains. In some cases, good personal relations lead to the establishment of effective working relations unknown to any organizational chart and certainly unknown to the higher echelons of an organization.[1] In others, open conflicts occur which the high executive, often innocent of technical knowledge, is ill equipped to solve. Thus "groups," "committees," "coordinators," and "expediters" — all makeshift solutions — are called upon.

Assuming the validity of a management principle which limits the direct span of control of an executive to from six to eight subordinate executives, we may be approaching a point which is described in Marxian theory as "the relations of production contradicting the conditions of production." Reports from Russia indicate that Communist industry, having now reached a capital-intensive stage, is no more exempt from these problems than we are.[2]

Is the Computer the Answer?

The giant electronic computer, with its three-dimensional ability to assemble, re-store, reassemble, and sequence random information vertically, horizontally, diagonally, selectively, or in any other manner required by the complexity of modern industry, presents some interesting possibilities with regard to the growing problem of industrial organization. One of these possibilities, auguring well for the systems and procedures man and

[1] Jasinski, "Adapting Organization to New Technology," *Harvard Business Review*, January-February, 1959.

[2] "Soviet to Peg Pay to Science Output," *New York Times*, April 15, 1959, pages 1, 8.

badly for the lower echelon operating executive, is the possible transfer of most routine decision-making to computers. The simple fact is that a large computer can accumulate, process, and utilize more information than thousands of human beings. Coupled with this is the fact that most routine decisions consist simply of processing various items of information by comparison, addition, or subtraction and of deriving an answer which leaves no alternative or which makes a selection based upon essentially automatic rules. The computer is superior to people as a maker of routine decisions. A spectacular demonstration of this superiority is provided by the Random Access Memory Accounting Computer (RAMAC)[3] used by United Merchants and Manufacturers, Inc., New York City.

This company's problem involves, in one of its divisions, the constant re-evaluation of consumer end-requirements in five or six styles, some 20 patterns, and enough color combinations to result in 8,000 different finished items to be produced from the same starting material (unfinished fabric). All must be cut and packed in a different manner for each of three major types of customers: apparel manufacturers, piece goods retailers, mail order dealers. This brings the total variety of end products to 24,000, all subject to the vagaries of weather as well as to unpredictable and sometimes kaleidoscopic changes in fashions.

Processing a customer order under these conditions involves a number of decisions such as whether to open a full case in order to ship one or two pieces and whether to supply a similar color in small quantity. A wrong decision, whether due to clerical error or to the inadequacy of the immediately available information can be costly. Before installing the RAMAC, the processing of an average order involved 15 human decisions by highly trained, but *fallible,* clerical personnel. These decisions are now made by RAMAC and the company's comptroller is authority for the fact that the computer has eliminated 6,000 to 15,000 daily human decisions and their inherent error potential.

[3]See "Installation of a 305 RAMAC," by Robert M. Anderson, *Systems and Procedures,* August, 1959, page 22.

Computers in Total Mobilization

Perhaps the most striking way to consider computer capacities is to select the biggest possible single job that may challenge our industrial system and imagine what a computer could do with it.[4] Let us select the problem of mobilizing the entire economy for defense. Let us imagine a giant computer, Mobilization Analyzer for the Determination and Control of Allocations and Priorities (MADCAP) to be used during a pre-war and subsequent active war phase.

Systems and procedures men in production scheduling will have no difficulty in recognizing most of the elements which would be involved though vastly magnified and with *time* a critical factor in programming for such economic mobilization. For example, an airplane is made up of many parts, some of which, such as motors and guns, are themselves assembled out of sub-components. Thus a delay in the production of even a minor sub-component or a shortage of the material required might have serious effects on airplane production. Furthermore, there would be no point in expediting the production of a component unless all components were sure to be available for assembly at the same time. In fact, the problem can be visualized in

[4]Max Carasso, "The Real Pushbutton War," *Army* October, 1958.

four aspects: (1) The range of end-items required, (2) The number required, (3) The materials, labor, and other factors essential to production, and (4) The time requirements. The importance of the last factor in decision making under emergency conditions cannot be too highly stressed. For example, a spectacular, new, and possibly decisive weapon with a required lead time of seven years for production may be passed over in favor of additional conventional weapons if the outcome of the war is expected in much less than seven years. In economic mobilization, *time* is a real fourth dimension, interchangeable with the other components of *type, quantity,* and *content.*

Complex Problems of Total Mobilization

Our "problem" begins with a qualitative determination of the end products essential to a totally mobilized economy. No machine can make this determination. For example, no machine can decide the answer to the question, with its psychological overtones, of whether or not face powder is essential. This is a human decision. But the principles for the decision, if it becomes necessary, can be programmed into a computer. Though space does not permit discussion of the question, it should be noted that World War II mobilization was rendered highly successful by the inspired concept of "relative essentiality," under which the supplies of less essential goods were progressively restricted.

Therefore, under the concept of *relative essentiality,* our mobilization program begins with a list of essential items of equipment and supply for military use. A second category of essentials includes products necessary to civilian survival and productive efficiency. Outside these two categories lies the remainder of the productive economy, unclassified products whose production will be discontinued as resources they use are needed in essential categories.

Priorities and Allocations

So far we have considered specific items, not quantities. When we consider quantities for a problem of total economic mobilization, there is no limit to the materials required. Priorities and allocations which govern production during total mobilization are directed toward obtaining maximum production while at the same time keeping the entire economy in balance. Since each end product results from a long and sometimes complex chain of production, priorities and allocations must follow the scheduled end products all the way down the line. Sooner or later, therefore, priorities and allocations come into conflict, requiring a *relative essentiality* decision. During the last war these decisions and their underlying calculations required the services of many thousand clerks and secretaries, together with a corps of mathematicians, statisticians, military officers, and civilians. This, then, is the problem — probably the biggest job in the world in terms of sheer bulk — which the MADCAP computer is visualized as handling.

MADCAP

We visualize an enormous room of which three walls are devoted to panels of flashing lights characteristic of computers. At each panel sits a small group of attendants; the person in charge of the group sits on a raised platform facing the center panel. Below him sits an assistant, flanked by two telephone switchboards and their operators. This panel is one of more than a hundred occupying the three walls which as a whole constitute a Visual Rapid Feasibility Estimator. At the fourth wall, on

a glass encased soundproof platform, sit the members of the august Allocations and Priorities Board, assembled for a major feasibility test involving the entire national economy, in terms of a logistical index (table of requirements) supplied by the Joint Chiefs of Staff.

The table specifies the items needed, when needed, and the quantities needed each period. The problem is to determine whether the economy can supply or exceed these requirements and to pinpoint or correct any surpluses or shortages. This lengthy table, on magnetic tape, is fed to MADCAP. One block on the tape, before being encoded for internal processing, reads as follows:

B-52 Jet Bombers, Standard Equipment:

1 January 1960 to 31 March	50	units
1 April to 30 June	100	"
1 July to 30 September	200	"
1 October to 31 December	300	"
1961, each quarter	300	"

After reading this, MADCAP searches its memory for an informational block corresponding to the item described. This block (Block I) lists such major components of a B-52 as armor plate, body, wings, engines, radio equipment, bomb sights, and guns as well as the ton-miles of transportation required to bring these major components to assembly and the man-hours required for actual assembly. Block II will look like this:

B-52 Jet Bombers, Standard Equipment:

Armorplate	B2512	14 tons	2800	V2834
Body	B5213	1	650	
Wings	B5214	2	300	
Engines	B5215	2	1200	
Radios	B5216	2	30	V4963
Man-hours required for assembly:				----
Time required for assembly:				----

Now making use of the ability of electronic computers to sequence operations automatically without human intervention, MADCAP proceeds without hesitation. Taking each component item in Block II, it multiplies it by the items in Block I for each period and accumulates the results for the next step.

Step 3 involves finding the block for each component specified in Block II. Let us note at this point that a systems and procedures man with both punched card and computer experience, as well as the systems specialist in production scheduling will already have thought of a commonly used alternative to the fully automatic process just described. In its simplest form, this alternative procedure involves the selection from a file, by hand, of a previously prepared deck of punched cards. Each card may contain the specifications and required quantities for a component. The inventory required for the production of an item would be a simple matter then of multiplying by the number needed, say a hundred, the items specified on each card. On such a small scale, the problem is simple, requiring no MADCAP. However, while similar in principle, such elementary procedures are not practical for problems of the scale and complexity of those involved in national economic mobilization. In Step 3, then, MADCAP would take each component item, such as armorplate, and search its memory for all data available on it. This would include data on requirements for producing it, how much armorplate could be produced quarterly, and how this production was allocated among various priority groups. MADCAP would examine each cycle of the vast and complex production system, not to ultimate conclusions, of course, but to practical limits previously established. These limits, which previously were established by rule of thumb, may in the future be determined more precisely with computers.

Limits will naturally vary with the nature of the material concerned. In the case of a strategic material it might be necessary to account for close to 100 per cent of the supply. Therefore, MADCAP would pursue every last ounce throughout our economy to its ultimate destination. On the other hand, a material like paper, with many varied civilian and military uses, would receive different treatment. Though controlled and allocated like everything else, a certain amount of waste and relatively unessential use would be tolerated. In fact paper, along with some metals and partially recoverable materials, might be considered part of a group in which the control of scrap might be as important as the control of the original product. This means that MADCAP's job would not end with controlling materials to their so-called end uses but would keep track of recoverable scrap and then recycle the scrap through the entire system again in a sort of endless chain.

In order to understand how all this is physically possible, let us return to our original input tape containing the table of requirements. If this table listed one or two thousand items, all the data in connection with them would fit on about 2,400 feet of magnetic tape which MADCAP would read in less than four minutes.

It is incontrovertible that MADCAP, as described, could effectively make all the evaluations and decisions required in an economic mobilization problem such as the one described. The important question then for a systems and procedures man is, "Do the potentialities of computers, as described in this paper, present any promise of resolving or ameliorating the organizational problem which increasingly afflicts business and government today?

Computers and Management

In the current state of technological flux, when two new problems seem to arise for each one solved, any answer to that question must be tentative. But two developments appear to be logical.

First, the centralization of information and the immediate availability of a central, impersonal data source should not only reduce the incidence of line and staff problems, but should also minimize the necessity of having committees of experts confer on a multitude of operational problems. At least, it should tend to restrict the use of committees to problems of a creative or high policy character. Optimistically we might even visualize computers replacing committees themselves at lower or intermediate levels. To the extent that committee decisions are the product of pooled information, a computer would equal or surpass a committee's efficiency. Of course, where imagination, ingenuity, or creativeness are required, the computer has nothing to contribute, at least in the present state of computer technology.

Second, while perhaps not directly affecting "overlayering" (since *they* will not replace high executives), computers can strike at overlayering by eliminating the bottom layers; that is, the lower echelons of junior executives and decision-making clerks. With fewer human (and fallible) decisions made, fewer executives would be needed at the next higher level to correct errors and adjust conflicts.

Since the improvement of procedures is one of the major pre-requisites of successful computer use, the future appears bright for systems and procedures men who understand the capabilities of computers. Of the knowledges needed by them, electronics is the least essential.

This is not meant to disparage the importance of electronic engineers in the further development of computers. Nor is this meant to imply that a knowledge of electronics is useless to a systems man. Far from it. The writer has often envied electronic experts their knowledge, with which it is possible to visualize computer processes more accurately. However, for the established systems man, an intensive study of computer electronics is among the least rewarding studies he can undertake.

Automatic Computers

The "automation" of computers through the development of automatic programming, simplified computer language, and canned programs will be a boon to the systems man. It will relieve him of the necessity of studying the translation into computer language of the specific instructions required. Until recently, these programming requirements took so much time that the use of computers was uneconomic for data-processing applications of a short-lived or frequently varying character. Their "automation" removes one more obstacle between the systems man and his access to the computer as a tool of his profession.

It must by no means be concluded that the old-line systems and procedures man will have a clear field. As the field grows in attractiveness, engineers, mathematicians, and others with a talent for systems and organization will enter it and perhaps preempt many of the top and middle positions. Eventually the best opportunities for a newcomer in the field may go only to those with all-around qualifications just as today the best opportunities in the legal and accounting fields go to those who are qualified both as lawyers and CPAs. But, present systems men will still have an advantage; they were there first. **s/p/a**

Work Measurement

► Work standards presuppose an ability to measure work. There are prime reasons why we need work measurement in the office. We need to evaluate the over-all efficiency of the office itself, we need it to measure the efficiency of some particular department or feature, and we need it to determine the efficiency of the individual office worker.

It is not sufficient to know that Betty Jones appears to keep busy all day. We need to know how many letters are written and invoices posted, and then we need to know how many should have been written and posted. We also need measurement in order to *plan* and *control* the work units, sections, and departments. Work measurement provides a means of putting a budget on a performance basis and of making it an "action document," a device for forecasting and appraising accomplishment. Work measurement makes its contribution both through budget formulation and budget execution.

A program of measurement goes hand in hand with a program of standards. One can have measurement without work standards but one cannot have work standards without measurement. Measurement provides data concerning the amount of work done. If an office supervisor does not know the amount of work done, he cannot readily compare it with the standard or the amount of work that

Standards and Standardization

goes hand in hand with standards.

A. M. Webster

should have been done. Without measurement he cannot know whether he is managing the office efficiently or whether he is employing more people than are actually required. Without measurement he has no objective method of judging between his better and poorer employees.

The analyst and supervisor will discover that measurable work constitutes between two-thirds and three-fourths of all work done in the office. Effective measurement of this portion of the work and the ultimate setting of work standards will mean definite progress and improvement in office operations. While precise measurement may be difficult at times, it is better to measure with some inaccuracy than not at all.

Establishing Standards

In establishing work standards, it is essential that the true meaning of standard performance be established to serve as a guide in evaluating employee accomplishment. Standard performance should mean performance comparable to that which would be expected of a properly trained, satisfactory employee. It should mean neither superior nor inferior performance, but rather a normal competent level of accomplishment.

The determination of competency and adequacy must be predicated on accomplishment based on sound standards together with sound judgment of the supervisor in distribution of work, to insure that the employee has a fair opportunity to realize a sustained rate of satisfactory performance. Employees should be encouraged to improve their skills and to proceed to maximum levels of production. When production is achieved on sound standards, it should be rewarded by official recognition, privileges, or increased compensation.

The practice of establishing work standards, which has been used in industrial situations for many years, is now being introduced into offices. To be usable in the office, standards must be expressed in basic elements which can, by using building block techniques, develop standard time for operations.

Due to the tremendous variety of operations in the office area, it is impractical to establish standards initially for complete operations. A small number of standards for *elements* provide the medium for creating standards for practically all operations found in office work.

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A program of office work standards can be one of the most important tools that management has for accomplishing its office function. Among the values are the following:

1. *Uniformity of Product*
   The uniform, simplified work procedures which are a cornerstone of the standards program, permit management to achieve a corresponding uniformity in work patterns.
   Good standards assure uniformity of methods in all forms of activity such as filing, setting up letters, typing invoices, and processing orders.

2. *Higher Quality*
   Simplified procedures, combined with job instructions which are inherent in a standard program, enable employees to improve the quality of their work. Employees cannot be expected to produce at a high quality level where work methods are cumbersome, procedures lack uniformity, and job instruction is inadequate or totally lacking.

3. *Increased Productivity*
   Standards mean reasonable production objectives. They serve as an incentive and stimulus, especially to employees whose productivity leaves something to be desired. They motivate employees to achieve a level of competence which results in an over-all increase in productivity.

4. *Production Control*
   Standards are an index of the work potential of employees; they show what management can reasonably expect in the way of production. They also permit scheduling of work requirements and the intelligent forecasting of production estimates and deadlines.

5. *Fuller Utilization of Personnel*
   When standards exist, it can be determined whether employees are being adequately utilized and whether they are performing competently.

6. *Improved Morale*
   Where standards have been established, employees need have no doubts as to whether they are meeting job requirements or whether supervisors are aware of their efforts. Their presence obviates the possibility of certain employees lying down on the job, a practice which, when not detected by supervisors, causes poor office morale.

Kinds of Work Standards

Essentially there are two kinds of work standards: quantity and quality. For quantity standards the chief consideration is the rate of production, or the number of units produced in a given period of time. For example, a quantity standard may call for a production rate of 150 lines of typed material per hour or the checking and approving of 320 invoices per day. Quality standards specify accuracy and precision. They are generally used in cases where quantity is a secondary factor. Such a standard may establish a spoilage norm of one document per thirty documents typed. In some cases, requirements may involve quantity-quality standards, where both the number of units and the accuracy of the production receive consideration.

Selecting the Time Unit

It is just about as important to choose the right unit of time as it is to choose the right unit of work. It is apparent that inappropriate units of measurement would mean a lot of needless work not only in

record keeping but in converting recorded data into summary reports for budgets, payroll, and accounting records.

A good program requires a time unit that will most conveniently apply to all forms of productive and non-productive time so that 100 per cent of each employee's time can be accounted for and properly related to the unit of output. The time unit selected must be:

1. Easily recorded and reported
2. Capable of verification (as by official time and attendance records)
3. Accurately reflective of actual time spent in the performance of work
4. Comparable over a period of time
5. Capable of distinguishing among the different types of work

The Reporting System

Procedures people should, by survey, determine what work they should and can measure. They should establish the terms of measurement — the operation work units and the man-hour time units. They should gather the actual time and work-load facts and put them to work. Gathering the facts means recording, and putting them to work means reporting. Simplicity must be the keynote. Even so the analyst will need:

1. Records and recording instruments for collecting work-load and time information.
2. Report forms and instructions for transmitting the recorded data
3. A procedure for consolidating and routing the key facts up the line and for routing summaries back down

To some extent this procedure has to be give-and-take. The basic forms and instructions have to be centrally designed and the instructions uniformly interpreted and applied. Uniformity in these essentials is a *must* in order that the raw data collected be valid and comparable, the computations made and conclusions drawn be equitable, and the results made available in a readily usable form on a time basis. The Systems staff, working closely with line people in all areas, must make every effort to:

1. Use existing records when possible, even though such records were originally designed for other purposes
2. Eliminate unnecessary records
3. Maintain records for operations at a single point wherever possible instead of having each employee maintain an individual record
4. Keep all of the recording processes simple by using the least number of records to produce the required data.

Methods of Setting Standards

When a review of all rate-setting practices has been made and all the various people involved in those practices identified, the principal rate-setting methods can be lumped under three headings:

1. Precisely engineered, stop watch, or synthetic
2. Subjective
3. Statistical

Precisely Engineered Standards

In developing engineered standards an individual job or operation is analyzed; its elemental motions are identified, needless ones eliminated, and others recombined as appropriate; and tools, equipment, work-place layout, and work flow are standardized. After this standardization, the job as performed by an operator of at least average ability is time-studied in detail.

By accumulating the time readings of the job, allowing for fatigue and other

delay factors, and applying a "leveling" factor to compensate for abnormal skill or effort on the part of the worker, a rate is derived which becomes the standard for all workers performing the same operation under standard conditions.

A variation of the above approach is known as setting synthetic standards. These are useful where jobs, although not alike as a whole, are made up of different combinations of *standard elements*. Synthetic standards are particularly useful in measuring work performed in offices. Standard elements are found to a large degree in this area. These elements, combined properly, furnish a rapid means of developing sound operation rates in an area that contains a high rate of diversification at operation level.

Subjective Standards

Subjective judgment enters, to some extent, into the setting of work standards by any method. In contrast to precisely engineered standards based on time and motion study, there are various rule-of-thumb standards based only on the experience and opinion of individual supervisors. Such "standards" are better than none at all. But when a supervisor makes a guess and has no basis upon which to explain and justify it, the general disagreement that ensues may more than offset any value the standard has.

Quite often production records exist which are not based on the kind of work and time units that are needed for work-measurement purposes. Such records, nevertheless, may provide quantitative information good enough to improve the subjective estimate being used as a standard.

In lieu of existing records, simple work-counts also are sometimes used as a means of taking some of the guesswork out of the subjective approach. Standards set by these methods can be arrived at quickly but that fact is one of the main reasons against their use, for there is often considerable disagreement concerning such standards in applicability, equitableness, and accuracy.

Statistical Work Measurement Standards

Going beyond the subjective approach, but not to the detailed precision of engineered standards, is the statistical method. The statistical work measurement standard combines sound statistical experience and analysis with the considered judgment of management, to arrive at standards that are attainable, applicable, relatively permanent, and equitable. The statistical method is more flexible than the stop-watch (time and motion) method. It can be applied at different levels of work and in the presence of varying (but certainly not unlimited) degrees of work standardization. Often the stop-watch and the statistical approach are used in combination. For example, the stop-watch can be useful in simplifying some of the tasks in an operation, even though the operation as a whole cannot be standardized. A simple, statistical reporting system can be installed as a satisfactory basis for production standards, provided the criteria agreed upon are carefully followed.

Standardization

Standardization is a broad term referring to the fixing of uniform specifications, practices, or methods. It may refer to a plan under which all office machines or equipment used must meet predetermined specifications, or to situations where a particular method, tested and approved, is being established as the method to be used throughout the organization. **s/p/a**

Richard W. Reynolds

Operations Research for Industrial Management, *by Dimitris N. Chorafas; Reinhold Publishing Corporation, 430 Park Ave., New York 32, 303 pp., 1958, $8.75*

► The purpose of this book is to present a detailed explanation of the most recently developed operations research techniques used for executive decision-making, with emphasis on so-called simulation studies. Simulation is used to arrive at decisions on a mathematical or rational basis rather than by less accurate intuitive or rule-of-thumb methods. Through simple examples, the reader is led into the fundamentals of simulation and of prototype models.

The book includes the application of operations research methods to such matters as financial allocation, transportation problems, inventory control, and production setups. The use of electronic computing in relation to operations research is for the first time duly emphasized. Also introduced are the most recently developed methods in evaluating alternative courses of action and in making major management decisions.

The material is presented as simply as possible so that those who are not mathematicians will be able to understand the import of the theories discussed. The book also includes sufficient description of the details of game theory, linear programming, simulation theory, flow techniques, and matrix algebra to be of the greatest interest to systems engineers, computer technologists, and others interested in applications of research and analysis to business and industrial problems.

With all of its accomplishments, however, the book does not solve the basic problem of explaining to non-mathematicians the potential application of operations research to the solution of every-day operations. The more books I read on the subject of Operations Research, the closer I come to the realization that a fundamental knowledge of higher mathematics is essential in order to add this "tool" to the Systems man's "tool kit." *(Reviewed by Thomas G. Rizzo, New York Life Insurance Co.)*

Work Measurement in the Office (a guide to clerical cost control), *by Elmer V. Grillo and Charles J. Berg, Jr.; McGraw Hill Book Co., Inc., New York, 186 pp., 1959, $5.75.*

In an area not new to the industrial engineer, but still fairly experimental in most offices, it is the stated aim of the authors of this text to acquaint business executives and others with the fundamental knowledge of how to measure and set standards for office work. The book meets this purpose quite adequately. It is primarily a basic, comprehensive text presenting the scientific as well as the more subjective techniques of measuring work.

The treatise should be a particularly valuable one to the systems or staff man since the authors have been especially careful to slant toward clerical operations, the major techniques developed and used so widely in industrial operations. The measuring methods described are: Work estimates, time records, stop watch methods, work sampling methods, micromotion studies and the use of predetermined time standards.

In any field of analysis work where the staffman or executive is faced with the decision of which technique will best meet the peculiar requirements of his operations, a sound evaluation of techniques is extremely valuable. In this respect the text provides excellent assistance. In addition to the description of the techniques, (including their weaknesses), a full chapter is devoted to a comparison of the six approaches. A summaried chart of advantages and weaknesses should be particularly helpful to those who anticipate initiating a measurement program.

The book is divided into three parts, of which the description and comparison of the various techniques actually form the central substance of the text. The first part of the book provides a general introduction to the subject and deals with planning and organizing a measurement program. The third part covers the important area of establishing and adjusting clerical work standards and deals with the often difficult area of integrating the measurement program with existing incentive policies.

Portions of the text are extremely readable, others venture off into technical treatise which many executives without special interest or background in statistical problems might find difficult in application. Considering that this book was designed for the twofold purpose of providing a study text for students as well as a handbook for executives, it meets its objectives most successfully, for it condenses an amazing amount of material and specific illustrations into two hundred pages. In addition to this, it provides a categorized list of references through which the reader can research further the measurement area of his choice.

(Reviewed by Anita P. Loeber, Los Angeles Chapter.)

Executive Control & Data Processing, *by Lowell H. Hattery, Anderson Kramer Associates, Washington, D.C., 92 pp., 1959, $3.95.*

Not a technical book about Electronic Data Processing, Dr. Hattery's latest contribution to the literature of management science, " . . . is intended to be a guide to the executive in meeting the challenge of using new data processing tools for more effective control." His analyses and conclusion make for fruitful reading, for the author writes from experience gained as Director of the Center for Technology and Administrative Studies, and as Head of the annual Institute on Electronics in Management, both at The American University in Washington, D.C.

Professor Hattery hits hard upon the need to know how to crawl first before trying to walk. Top management must be able to identify what a good report consists of, set-up a system to insure a steady flow of quality reports, and then, know how to use these reports to full advantage. Only then, will administrators be able to optimize their gains from EDP without being inundated by a flood of worthless, and even misleading reports which these machines can spew forth by the carload.

The writer cites the emerging demand for more data because of:

(1) Growth of organization, geographic dispersion, and decentralization.
(2) Competition.
(3) Development of better control techniques.
(4) Availability of electronic data processing equipment.

Examining this demand, he points out that, "There are, however, important differences in the problems of introducing electronic data processing systems and

inaugurating new reporting systems which call for a higher degree of personal attention from top management, even to the point of keeping up with major equipment developments." Dr. Hattery believes the answer to good reports and their control in this era of EDP may lie in the setting up within an organization of a Department of Administrative Information having control over Administrative Reports, Data Processing, Statistical Analysis, Visual Aids, and Physical Communications. To maximize the effectiveness of such a department, the author urges that, "The assignment of a vice-presidential level to responsibility for data processing and reporting systems will provide a mechanism for top management participation."

The goal is for top management to determine what it wants and then set up an apparatus to get it. For as Professor Hattery puts it, "The executive may well receive too many digits but it is seldom he receives too many reports."

Executive Control and Data Processing is a concise, informative, and uncomplicated primer for the alert executive who must review old principles and learn new ones pertaining to reporting systems so that he can profitably utilize for his organization the kind and number of reports that EDP will generate. *(Reviewed by Maurice F. Ronayne, Management Analyst, Digital Computer Systems, Middletown Air Material Area, USAF, Penna.)*

Management's Mission in a New Society, *edited by Dan H. Fenn, Jr., McGraw-Hill Book Company, Inc., New York, 345 pp., 1959, $6.00.*

Systems executives in the Systems and Procedures Association have been setting off many alarm clocks throughout the past year. The warning can no longer be ignored that business environmental conditions are changing swiftly and that the role of the Systems executive must change rapidly in order to meet them.

Management's Mission in a New Society is the edited transcript of the proceedings at the 50th Anniversary Conference at the Harvard Business School. At this conference, some 2,000 of our country's top executives met to discuss in organized fashion basic questions which touch their lives. These questions referred not to the "hows" of day-to-day managerial life, but to the "whys." If the Systems executive is to be successfully graded upward towards top management levels, it is logical that he gain, without delay, all possible perspective and insight into top management's thinking about changing environmental conditions. This book will be of prime interest to all Systems personnel desiring to develop such perspective.

Each chapter is authored by an international authority in business management, government, economics, management research, or other field. The presentations go deeper than the functional problems of operational planning and control. The collective effort is to face the new conditions, examine and define them, and to develop a logical philosophy and policy of operation to meet them.

Of especial interest to Systems executives will be the chapters on "Managing the Educated" by Peter Drucker and "New Directions in Human Relations" by Lombard, Zalesnik, and Roethlisberger.

Also affording excellent perspective is the included script of a movie "The Athena Electronics Company" which was shown at the conference. Although the incident involved is fictional, it is based

on facts drawn from a number of firms which have gone through a similar experience. It can afford one the vicarious experience of actually juggling a typical knotty problem such as currently confronts many top executives. *(Reviewed by Henry G. Duden, Assistant Secretary, Manufacturers Trust Company, New York.)*

Professional Creativity, *by Eugene K. Von Fange, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 260 pp., 1959, $4.95.*

Whether your job is to invent a better mousetrap or to design a new business system, you are engaging in a creative process. By careful attention to the many factors that make up this creative process, you can learn how to do a more effective job. These factors are explained by Eugene Von Fange in his book, *Professional Creativity,* which he has developed out of his experience in conducting seminars in creative engineering at the General Electric Company for a number of years.

Lest anyone jump to the conclusion that this is merely a treatise on brainstorming, it should be noted that the author lists brainstorming as only one in a series of eight different techniques which he describes for combining knowledge into new ideas — and he devotes only a scant half dozen pages to the brainstorming technique.

In the first 8 chapters, the author attempts to convince the reader that everyone has creative talent and can learn how to use his mental powers and resources to create new ideas. Unfortunately, Von Fange starts off at so pedestrian a pace that the professional systems man may lose interest after scanning the first two or three chapters. However, he will find more rewarding material in chapters 4 to 8 which deal with the use of various techniques for putting latent creativity to work, the ways to utilize knowledge as raw material in the creative process, the need for motivation to start the process going, and the manner in which it is enhanced by judgment and reflection.

In the final 8 chapters, Von Fange sets forth his six-phase plan for solving problems in the area of creativity. These phases are concerned with establishing worthwhile objectives, developing efficient methods for conducting creative work, and gaining acceptance of results.

The last 38 pages contain reprints of articles by Charles F. Kettering on how to develop inventors and by Paul R. Lawrence on how to deal with resistance to change, plus a short bibliography and a curious index.

This book has something in it of definite value to the systems man. It is suitable for use as supplementary reading for a basic systems course, as a reference title for in-plant training, or as a text for a seminar on creative thinking.

Worth remembering is Von Fange's equation for achievement (p. 115): Man's aptitude and experience, multiplied by his efficiency, equals his achievement. By efficient scheduling of his time and effective application of his faculties, an average man can succeed; conversely, a brilliant man can fail. *(Reviewed by Gibbs Myers, Kearfott Company, Inc., Little Falls, New Jersey.)*

The Allocation of Economic Resources, *by Moses Abramovitz and Others; Stanford University Press, Stanford, California, 244 pp., 1959, $5.00.*

This is a collection of thirteen essays by noted scholars, covering a broad area

in economic research. The "Economic Resources" are manpower, technological heritage, accumulated capital, financial structure, etc. "Allocation" refers to the forces that cause these resources to be used in various combinations which result in a total output of goods, services, and new capital, and, in turn, the distribution of this output as payment for the use of the resources.

Each of these essays adds to the increasing store of knowledge in economic research. In some, existing theories are expanded, polished, or shown to have deficiencies through the use of mathematical models based on actual empirical studies. Through works of this kind, the broad approximations of classical economics, in which forces tend toward equilibrium, are being refined to provide an explanation of observed "disequilibriums." Although these essays are not necessarily the final word in the areas covered, they do sharpen the tools of the economist who will ultimately build a perfect model of economic interrelationships.

The essays, generally, are directed to the professional economist or student. Theories criticized or refined have been summarized to a limited extent, and are explained in detail only in several instances. Each of the writers has had to rely heavily on the reader's previous understanding of material in the field; otherwise, each essay would of necessity have become a lengthy document. The essays are amply footnoted and in most cases each writer includes a reference list of ten to twenty selected works by well-known authorities in the field. *(Reviewed by Gordon M. Nonnemacher, Empire State Chapter, SPA.)*

s/p/a

Worth Reading

S. Joseph Schneider

"Breaking the Paper Work Bottleneck," Robert L. Blurton, *American Business,* June, 1959.

►Generalized treatment of improvements made at Beckman Instrument (Fullerton, Calif.). Pre-punched cards are used to write 80 per cent of the data required on 2,000 sales orders monthly. Purchase order redesign resulted in 50 per cent time reduction in preparation of 1,600 orders monthly.

"Setting Goals and Schedules for Paperwork Cost Reduction," Frank M. Knox, *The Controller,* July, 1959.

Discusses a vertical and horizontal approach to paperwork cost reduction. Suggested steps for the horizontal approach are:

1. Draw up a table of functions, evaluate the procedures, and decide the order in which they should be handled.
2. Chart the procedures, using a chart which can be read quickly by all who must see it.
3. Analyze the operations and determine control points.
4. Recommend to management that which can be eliminated.
5. Analyze the methods for necessary clerical operations.
6. Investigate mechanization.
7. Chart the revised procedure, developing work measurement data.

8. Obtain approval of the new procedure.
9. Instruct supervisors and workers in the new procedure.
10. Install the new procedure, using the "dry run" method for debugging, when necessary.

Suggested steps for the vertical approach are:

1. Select an area for study, small enough to be handled effectively.
2. Chart segments of procedures falling within the area.
3. Inventory the forms, machines, and files used in the area.
4. Conduct supervisor instruction in work measurement and simplification.
5. Take an inventory of tasks performed by the workers, including supervisors, with time and output notations for each task.
6. Punch and tabulate the task data, relating each task to forms, machines, and files.
7. Analyze the task data and translate it into time and output for clerical operations as shown on procedures charts.
8. Summarize the task data for use by supervisors.
9. Apply work simplification to the tasks and establish work standards.
10. Analyze office machine and forms use.
11. Establish a formula for the most efficient level of clerical staffing and when to use outside, part-time labor.
12. Establish labor budget forecasts with data from the inventory of tasks.

"Cut Inventory Costs with Magnetic Card Files," *Management Methods,* July, 1959.

Brief illustrated description of Magna-Dex cards used for tool inventory and as a traveling requisition. Magna-Dex filing cards have small pieces of steel laminated into them. These are repelled by magnets in the rails of the filing tray, thus causing them to fan out. This makes it easier to find any card. Samples are shown of an inventory and requisition card.

"Cut Accounts Payable Costs—Now," *Modern Office Procedures,* July, 1959.

Describes Wright Aeronautical Division's system which handles 1,000 invoices and 500 purchase orders daily. Seven pairs of bookkeeping machines coupled to card punch machines are used. Three basic steps form the system:

1. Setting up a commitment from a purchase order.
2. Creating a liability and distributing costs from an invoice.
3. Checkwriting from an accounts payable voucher.

Punched card by-products are used for verifying operations and listing the transactions.

"Forms — A Plan for Controlling the Cost of Having Them Printed," Frank E. Griffin, *Office Executive,* April, 1959.

Brief statement of Chrysler Corporation's form control program. Stresses relationship with forms printers.

Publishers:

1. *American Business,* Dartnell Publications, Inc., 4660 Ravenswood Ave., Chicago 40.
2. *The Controller,* Journal of the Controllers Institute of America, 1 East 42nd St., New York 17.
3. *Management Methods,* Management Magazines, Inc., 141 E. 44th St., New York 17.
4. *Modern Office Procedures,* Irving B. Hexter, 812 Huron Road, Cleveland, Ohio.
5. *NAA Bulletin,* National Association of Accountants, 505 Park Avenue, New York 22.
6. *Office Executive,* Journal of the National Office Management Association, Willow Grove, Pa. **s/p/a**

An Outgoing Personality

► Systems and procedures men require outgoing personalities. The ability to meet people and talk with them is a basic part of systems work. People and paperwork involve many human relation as well as system and procedure problems. Take, for example, the way a project is assigned to your systems and procedures department. Does the boss call you into his office and make the job assignment? Or, what amounts to the same thing, does he "buck" you a piece of paper representing a problem and ask you to look into it for him? Do other department heads in the company come to you with their problems?

How often does a subsequent investigation reveal that there really was no problem at all, or else the problem which existed can be solved by getting personalities into harmony. A systems man often must serve as a company psychologist and "hear out" personality problems. It is, in fact, important to gain the confidence of department heads in this category, for sooner or later they may spell the difference between success or defeat to some of your best systems. Their importance as a source of systems projects and of over-all support cannot be minimized.

Do you initiate work in the area you like the best? An expert in a specific area may tend to over-specialize. In systems and procedures work, we cannot afford to limit ourselves to those areas in which we find ourselves most at home. Do you initiate work in an area for the department head with the biggest department or the most demanding voice or for the one who wields the most influence? While it is still true that the squeaking wheel gets the grease, it may also be true that a relatively silent wheel may be brewing future trouble.

How do we prevent things from overcoming us? No matter how heavy the pressure of our day-to-day assignments, we must take time each week for some "outgoing" personality activities: (1) Visit all department heads periodically and informally review with them the status of present policies and procedures affecting their areas; (2) Ask department heads about their procedural problems. Invite gripes; (3) Interview new employees after they have been on a job a month or so. They may uncover excess fat in an operation which calls for a new procedure; (4) Visit other companies to see what they are doing to streamline clerical operations. No one has a monopoly on efficient operations; (5) Meet and talk to other systems and procedures people. A mutual exchange of ideas is a healthy practice.

The value of the systems and procedures profession and the value of our own jobs to our companies can be measured in direct relation to the cost-saving ideas we develop. Ideas germinate more rapidly in a climate conducive to "outgoing" personalities. (Louis C. Doyle, Detroit Chapter, SPA; Treasury Staff, Chrysler Corporation). **s/p/a**

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